

THE WEAPONIZATION OF SPACE
A STRATEGIC ESTIMATE

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U. S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE WEAPONIZATION OF SPACE DEBATE: A STRATEGIC ESTIMATE, by
MAJ Claire E. Steele, 77 pages.

The weaponization of space is a long debated topic. So far, space-based assets have not been targeted, although the technology exists to permit this kind of attack. The central research question is: Should the U.S. develop and employ space-based weapons? The nature of the threat leads the U.S. to three possible courses of action: keep space sanctuary, develop defensive weapons and measures only, or develop offensive and defensive weapons. Each course of action affects the U.S. national instruments of power: diplomatic, information, military, and economic, in different ways. The best course of action for the U.S. to take is to develop defensive weapons and measures only.

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LIST OF ACRONYMS

AFDD	Air Force Doctrine Document
ASAT	Anti-satellite
BMD	Ballistic Missile Defense
CINC	Commander-in-Chief
CGSOC	Command and General Staff Officer Course
DOD	Department of Defense
EMP	Electromagnetic Pulse
FAA	Federal Aviation Administration
FAS	Feasibility, Acceptability, Suitability
FM	Field Manual
GEN	General
GPS	Global Positioning System
ICBM	Inter-continental Ballistic Missile
JP	Joint Publication
LEO	Low Earth Orbiting
LTC	Lieutenant Colonel
MAD	Mutually Assured Destruction
MAJ	Major
NASA	National Aeronautics Space Administration
NCA	National Command Authorities
NMS	National Military Strategy
NSS	National Security Strategy
SDI	Strategic Defense Initiative
TRADOC	Training and Doctrine Command
TTP	Tactics, Techniques, and Procedures
TV	Television
US	United States
USACGSC	United States Army Command and General Staff Officer Course
USAF	United States Air Force
USASMD	United States Army Space and Missile Defense Command
USCINCSpace	United States Commander-in-Chief Space Command
USSPACECOM	United States Space Command
WMD	Weapons of Mass Destruction

CHAPTER 1

INTRODUCTION

The weaponization of space debate has been ongoing since the 1940s when Project RAND stood up to study national security scientific issues. The weaponization of space is employing offensive or defensive weapons in outer space. Some believe space is a sanctuary and should be kept free of offensive and defensive weapons. Others call for full employment of offensive and defensive weapons based in space. A third contingent believes there should only be defensive weapons located in space. The definition of weaponization differs from militarization. Militarization of space is using space assets for military purposes such as reconnaissance or communications. Militarized space assets are not necessarily weapons.

“Space capabilities have become so intertwined with US society that continued unimpeded access to space has become a vital US interest.”¹ The US is concerned about unobstructed access to space. Numerous government documents and studies call for space control, which is the ability to assure access to space, freedom of operations within the space medium, and an ability to deny others the use of space.² However, US words and actions differ. Currently, there are no weapons in space. There are, however, terrestrial weapons that can attack space assets. In the past, the US spent money on research and development associated with the strategic defense initiative and now theater ballistic missile defense, but the fact remains that outer space is still free of weapons.

Thesis Questions

In order to address the issue of the weaponization of space, the question that must be asked is, should the US develop and employ space-based weapons? In order to

respond to that question, the next question must be, is there a potential threat? The level of threat should dictate the level of response. This leads to the next question, what should the US response to the threat be? Three possible US responses are: (1) keep space sanctuary and do nothing; (2) develop defensive weapons and measures only; and (3) develop offensive and defensive weapons. The US response directly corresponds to the US national power, which is the control and influence the US has over other sovereign nations.³ The last question that must be answered is how do the courses of action affect the national instruments of power? The national instruments of power--diplomatic, informational, military, and economic--are the ways a nation has the power to act when confronted. Answering these questions will clearly organize the course of action development for each position. The answers will assist in concluding which path the US should take.

Significance of This Study

This study presents an objective view of the weaponization of space debate. Previous studies either present the argument from a single point of view or present both sides and fail to select a course of action. This thesis studies the debate from the perspective of the US in the format of a strategic estimate. The strategic estimate is a tool presented by Joint Publication 3-0, *Doctrine for Joint Operations*. The purpose of the strategic estimate is to assist the unified commander in conducting a strategic analysis and an evaluation of courses of action. This thesis explores the question of the threat to the US and develop three possible US responses. Next, it will measure the effects of the three courses of action on the national instruments of power--diplomatic, information,

military, and economic. Finally, it will evaluate each course of action in terms of cost, benefit, and risk and recommend a course of action for the US.

Background

In his book *The Militarization of Space: US Policy, 1945-1984*, Paul B. Stares researched why the US and the Soviet Union never extensively deployed space weapons. Both countries had the capacity to develop space-based weapons, but as of 1984, neither chose to aggressively pursue them. Stares explained, “US policymakers from the outset wanted to avoid an arms race in space, but not at the price of limiting their freedom of action to use space for military purposes, particularly satellite reconnaissance. These two goals were reconciled by the argument that space could and should be used for ‘peaceful,’ that is non-aggressive, purposes.”⁴

Stares further stated, “Although the tacit acceptance of satellite reconnaissance undoubtedly removed a major source of conflict, it did not preclude the development of space weaponry altogether.”⁵ He discussed both countries’ development of anti-satellite (ASAT) weapons and concluded that the US did not need a robust ASAT capability because of a limited Soviet threat. Stares mused about why the Soviet Union, who could have benefited from countering US space systems with ASAT, did not appear to put emphasis or money into an ASAT program. He concluded that the low reliability of existing Soviet systems, the high cost, and more pressing priorities in military research were the explanation.⁶

Stares’ research ended in 1984. Since then, the Cold War ended and space systems have become more important to world societies, especially the US. “The ability of space systems to provide access to any region on the globe, and provide total

continuous coverage for such mission areas as navigation and missile warning, make them a cornerstone of its [US] defense forces.”⁷ The National Defense University’s *Strategic Estimate for 1999* concluded, “Forces hostile to US interests likely are studying how to attack space networks.”⁸ Is there a post Cold War threat? If so, what is the best course of action for the US? This thesis will answer those questions.

Assumptions

1. The dollar figures on the sources consulted are close to correct if multiple sources for each figure exist.
2. The data on the space assets of other countries are accurate. In some cases, the figures are available only from one source.
3. The US *National Security Strategy* will not change significantly before May 2001, based on the new presidential administration.
4. Classification of material will not impede research.

Limitations

This thesis contains unclassified material only.

Delimitations

Research cutoff date is 31 January 2001.

Key Terms Used in this Thesis

Active Defense: To detect, track, identify, intercept, and destroy or neutralize enemy space or missile forces. Active defense operations include maneuvering the spacecraft, deploying mobile ground links and terrestrial-based elements, and deploying decoys. It may also include the employment of lethal protection methods.

Anti-Satellite (ASAT): Any weapon designed to destroy satellites.

Assured Access: Allocation of the necessary satellite resources to form communication links or networks when needed throughout the strategic, operational, and tactical areas of operation.

Bandwidth: The width of a given band or spectrum of frequencies of interest expressed in hertz. The lowest usable frequency subtracted from the highest usable frequency for a communication channel gives its bandwidth.

Control Segment: The personnel, equipment, and facilities responsible for the operation and control of the satellite and, in many communications systems, control of users' transmissions through the satellites.

Defensive Counterspace: Active and passive actions to protect US space-related capabilities from enemy attack or interference.

Diplomatic Power: The art of communications and relationships in the global environment.

Economic Power: A nation's possession of and need for minerals, products, and services in global trading.

Full Force Integration: The integration of space capabilities into air, land, and sea capabilities; includes operations that multiply the effectiveness of the joint force by enhancing battlespace awareness and providing warfighter support in the areas of reconnaissance and surveillance, environmental monitoring, communications, imagery, global geospatial information and services; and positioning, navigation, and timing.

Geostationary: A satellite in orbit that appears to remain in the same position above the Earth is called a "geostationary satellite." It can also be written "geostationary orbit."

Global Partnerships: International support for the leveraging of civil, commercial, intelligence, national, and international space systems for military operations. The main effort focuses on domestic partnerships, but international opportunities are also pursued.

Global Positioning System: Space-based radio navigation systems that can calculate a user's position almost anywhere on the Earth.

Informational Power: The conscious use of communication to inform foreign publics regarding US politics and actions for the purpose of affecting these publics in ways favorable to US national interests.

Low Earth Orbiting (LEO): There is no formal definition of what constitutes a low earth orbit, but it is generally considered to have an apogee (maximum altitude) of no more than approximately 530 miles.

Military Power: The collection of a nation's weapons and equipment, trained manpower, organizations, doctrines, industrial base, and sustainment capacity.

National Systems: A term used generically to refer to any asset used by the intelligence collection organizations of the US, especially space-based systems.

Negation: Applying military force to affect an adversary's space capability by targeting the ground links or orbital segments of a space system.

Offensive Counterspace: To destroy or neutralize an adversary's space systems or the information they provide at will through attacks on the space, terrestrial, or link elements of space systems.

Passive Defense: To reduce the vulnerabilities and to protect and increase the survivability of friendly space forces and the information they provide. Passive defense

includes measures, such as encryption, frequency hopping, and hardening. Camouflage, concealment, deception, redundancy, mobility, and dispersion also defend space systems.

Payload: The payload's functions and capabilities are the reasons a satellite is placed in orbit. The payload provides space-based capabilities to the users and distinguishes one type of satellite from another.

Prevention: Measures to preclude an adversary's hostile use of third party or US space systems and services.

Protection: Requires warning of possible threats, notification of possible attacks, cross-cueing other owners or operators, and directing possible responses.

Satellite: An object in space that is in orbit around another more massive object.

Sensors: Electronic equipment used to find things. Sensors can be either active or passive.

Space: The universe outside of the Earth's atmosphere. There is no universal definition of where space begins or ends. For army purposes, it is practical to define space as being the universe beyond the minimum altitude of a satellite in a circular orbit, about 89 miles.

Space Control: The ability to assure access to space, freedom of operations within the space medium, and an ability to deny other the use of space, if required.

Space Sanctuary: The act of keeping space free of space-based weapons. It also encompasses not developing terrestrial weapons that can attack space-based assets.

Space Segment: The satellite placed into orbit or components used to launch the satellites.

Space Surveillance: The network of dedicated, collateral or network contributing space surveillance sensors.

Space System: An organization made up of equipment, some of which is in space, and people whose purpose is to perform specific technical tasks with the equipment.

Space systems are almost universally made up of three principal subsystems or segments: the space segment (satellite), the user segment (equipment and persons used to exploit the satellite's products), and the control segment (equipment and persons dedicated to maintaining the satellite).

User Segment: The personnel, equipment, and facilities that use the capabilities provided by the satellite payload.

Summary

This thesis will explore whether there is a post-Cold War threat to US space systems. If there is a threat, how will the US attempt to counter the threat? Will the US select space sanctuary, defensive weapons and measures only, or full-offensive and defensive weapons capability? The above courses of action will be evaluated according to their effects on the national instruments of power: diplomatic, information, military, or economic. Each course of action will also face the feasibility, acceptability, and suitability test. Finally, the best course of action for the US will be recommended.

CHAPTER 2

LITERATURE REVIEW

The literature review encompasses all literature involved in the research of the primary question, should the US develop and employ space-based weapons? First will be a discussion of potential threats. The discovery of a potential threat will validate asking the primary question. The next question is what should the US response to the threat be? Three possible US courses of action are:

1. Keep a space sanctuary and do nothing
2. Develop defensive weapons and measures only
3. Develop offensive and defensive weapons

Regardless of the outcome of the US response, how will the chosen course of action affect the national instruments of power: diplomatic, information, military, and economic? This is the final topic of the literature review.

Is There a Potential Threat?

The National Command Authorities (NCA) believe there is a potential threat to critical US communications infrastructures that rely on satellite systems. Former president of the US, William J. Clinton discussed the communications infrastructure as a vital US interest in *A National Strategy for a New Century*. “We also face threats to critical national infrastructures, which could take the form of a cyber-attack in addition to physical attack or sabotage, and could originate from terrorist or criminal groups as well as hostile states.”⁹ Clinton professed that the US will defend national interests with the military, “unilaterally and decisively.”¹⁰

Former Secretary of Defense William S. Cohen predicted future strikes on US space systems in his 1998 *Annual Report to the President and Congress*. “Because of the value of space systems to the US economy and the military in future conflicts, the US can expect attacks against US and allied space systems.”¹¹ He further stated, “The spread of indigenous military and intelligence space systems, civil space systems with military and intelligence utility, and commercial space services with military and intelligence applications poses a significant challenge to US defense strategy and military operations.”¹²

Three years later, in his 2001 *Annual Report to the President and Congress*, former Secretary of Defense Cohen reiterates his position. “The ability of the US to access and utilize space is a vital national security interest because many of the activities conducted in space are critical to its national security and economic well-being. Potential adversaries may target and attack US, allied, and commercial space assets during crisis or conflict as an asymmetric means to counter or reduce US military operational effectiveness, intelligence capabilities, economic and societal posture, and national will.”¹³ Cohen is consistent in his belief that there is a threat.

In addition to the NCA, the former Chairman of the Joint Chiefs of Staff General John Shalikashvili also believed there is a threat to space assets. General Shalikashvili called these threats an “asymmetric challenge” in the current *National Military Strategy*. He specifically mentions an adversary denying the US access to critical overseas infrastructure, “exploiting commercial and foreign space capabilities, threatening our space-based systems, and interrupting the flow of critical information.”¹⁴ Shalikashvili

concluded that these are legitimate military concerns requiring a possible military solution.

The National Defense University Institute for National Strategic Studies, also concluded the US is at risk from an attack on space systems. In *Strategic Assessment 1999: Priorities for a Turbulent World*, the authors state, “Technologies exist today that could challenge US dominance in space. Satellites are vulnerable to attack or disruption, particularly commercial satellites that lack the hardening of military systems.”¹⁵ The authors quantify their position with the assertion that satellites can be readily tampered with by anyone. “Satellites can be attacked directly by jamming or nuclear electromagnetic pulse and radiation. Today, equipment purchased in any reasonably sized shopping mall can easily jam local GPS signals from a satellite orbiting at 11,000 nautical miles.”¹⁶

The NCA, the Chairman of the Joint Chiefs of Staff, and the National Defense University all believe there is a potential threat to space assets. That alone warrants a study of the primary question, should the US develop and employ space-based weapons? The space sanctuary advocates, Lieutenant Colonel Bruce M. DeBlois, Major Howard Belote, Dr. Robert Bowman, Lieutenant Colonel Larry K. Grundhauser, Major David Ziegler, and the Union of Concerned Scientists do not deny the existence of potential threat. They simply advocate using diplomatic means to counter the threat. The space sanctuary advocates will be discussed in the following section.

Now that it is established that there is a threat, the next question asked is what should the US response to the threat be? Three possible US responses are: keep space sanctuary and do nothing, develop defensive weapons only, and develop offensive and

defensive weapons. Each of these responses represents a separate course of action to be explored in chapter 4. Each course of action has its own patrons and will be reviewed in the next three sections entitled “US Possible Response.”

US Possible Response: Space Sanctuary

Space sanctuary is the act of keeping space free of space-based weapons. It also encompasses not developing terrestrial weapons that can attack space-based assets. The space sanctuary advocates all believe that the US should pursue treaties against the development of space-based weapons and ASAT weapons of all kinds.

In *The Fallacy of Star Wars, Why Space Weapons Can't Protect Us*, the Union of Concerned Scientists provided historical background up to 1984 on the development of space weapons. The Union of Concerned Scientists panel on ballistic missile defense (BMD) included professors of physics from several American universities, a member of the Manhattan Project, a Navy admiral, a member of the Central Intelligence Agency, several personnel formerly involved in forming the US government's space policy, and Dr. Carl Sagan. The Union of Concerned Scientists believes that a diplomatic solution is necessary and include a draft of a proposed US-Soviet treaty on ASAT. The Union of Concerned Scientists concluded, “Only a treaty that forbids all space weapons tests can protect our most valuable military satellites, while an unconstrained pursuit of space-based missile defenses will undermine US security. Such a treaty would still permit research on strategic defenses, and would not close the door forever to the defense-dominated world that all desire.”¹⁷

Lieutenant Colonel Bruce M. Deblois, US Air Force (USAF), wrote an article for the winter 1998, *Airpower Journal*, “Space Sanctuary: A Viable National Strategy.”

Deblois summarized the history of the space sanctuary position and evaluates sanctuary, using criteria of political concerns, adversarial potential, technical limitations, financial trade-offs, practical considerations, and emotional appeal. Deblois believes that the US pursues the weaponization of space on an assumption that weaponization is inevitable, because of the nature of man to wage war. Deblois stated that the social nature of people can change, as evidenced by the global attitudes towards slavery today, as compared to 150 years ago.¹⁸

Major Howard D. Belote, USAF, wrote “The Weaponization of Space: It Doesn’t Happen in a Vacuum” for the *Aerospace Power Journal* in the spring 2000 issue. Belote does not believe that the threat to the US is enough to warrant space-based weapons. He examines five articles collected from a thirty-year span of professional Air Force journals. Four of the articles advocate development of space-based weapons and the last one calls for space sanctuary. Belote started with a 1968 article by Major General Oris B. Johnson, forecasting the inevitability of space-based weapons. He ends with Lieutenant Colonel Deblois’s space sanctuary article. He characterized the first four authors as “zealots”¹⁹ and reinforced Deblois’s position that social attitudes can change. Belote concluded that the US would be overreacting if it pursues space-based weapons and asks the question, “why fix something that is not broken?”²⁰

“Arms Control in Space,” an article written by Dr. Robert M. Bowman originally appeared in the *Air University Review* in 1985. Dr. Bowman, a former Air Force officer, was the president of the Institute for Space and Security Studies, Potomac, Maryland. Dr. Bowman presented options for ASAT and BMD and concluded that the US should join the Soviet moratorium on ASAT testing. Bowman believes in a diplomatic solution

because developing space-based weapons puts both countries in “positions that are patently inequitable and nonnegotiable.”²¹ “Sentinel’s Rising: Commercial High Resolution Satellite Imagery and Its Implications for US National Security,” appeared in the winter 1998, *Airpower Journal*. The author Lieutenant Colonel Larry K. Grundhauser wrote a short history of the legal status of satellites and discussed the threat of commercial imagery to US security. Grundhauser believes in “negotiation over negation” and called for a political solution. “Although there is great temptation to address the threat posed by commercial imagery satellites with ASAT weaponry, their use could actually encourage others to place US satellites and/or ground infrastructures in jeopardy. A better approach would be US sponsorship of a legally binding treaty on the rights and obligations of remote-sensing countries with respect to data distribution.”²² Grundhauser believes the US should keep the status quo in the near term and the US should not deploy space-based weapons until the future is more apparent.

Safe Havens, Military Strategy, and Space Sanctuary Thought was written in June 1988 by Major David W. Ziegler, USAF, for the Air University at Maxwell Air Force Base, Alabama. Ziegler was a student of Lieutenant Colonel DeBlois. He focused on a strategist’s view of the sanctuary position. “The sanctuary position should never be construed as a passive national strategy . . . strategists who conclude that American national interests are indeed served by introducing space weapons will still find the sanctuary perspective invaluable to their planning.”²³ Ziegler explored the question from a position of national interest and concluded that other nations will start seriously developing space-based weapons only if the US does so first. He further implored future strategists to consider space sanctuary when defining future space policy.

Frederick W. Kagan's article, "Star Wars in Real Life: Political Limitations on Space Warfare," appeared in *Parameters* in August 1998. Kagan is a strong advocate of theater missile defense. However, Kagan believes that the US and its adversaries should agree not attack each other's satellites. He stated that the US should retain its intelligence and communications with the understanding that the enemy has a similar capability. Kagan believes that the degradation of US capabilities by the loss of US intelligence and communications would be of greater concern than the problem posed by the enemy having the same access to space systems. The US should "refocus our efforts to attack the enemy shooter systems and the links between the sensors and those systems."²⁴

In summary, the Union of Concerned Scientists, Deblois, Belote, Bowman, Grundhauser, Ziegler, and Kagan all believe the US should pursue a diplomatic solution to the weaponization of space debate instead of a military solution. Space-based weapons are not inevitable if the US does not lead the way. Under the keep space sanctuary course of action, the US should not be the first nation to weaponize space.

US Possible Response: Defensive Weapons and Measures Only

Those who believe the US should defend itself from threat using space-based assets subscribe to the defensive weapons and measures only policy. Air Force Doctrine Document (AFDD) 2-2, *Space Operations*, defines defensive counterspace as,

Active and passive actions to protect US space related capabilities from enemy attack or interference Active defense operations include conducting surveillance of adversary launch sites, identifying and neutralizing blinders and jammers, and maneuvering spacecraft. Reporting potential and known space system attacks is an important aspect of active defense Passive defense includes survivability measures such as redundancy, filtering, frequency hopping, command and mission data link encryption, and hardening. Also, camouflage, concealment, deception, redundancy, mobility, and dispersion can defend elements of a space system.²⁵

The USAF definition of active counterspace allows for employment of offensive lethal protection methods if used as a defensive measure.

The late Lieutenant General (Ret.) Daniel O. Graham, USA, published three books in the mid-1980s supporting the defensive weapons only position. *The Non-Nuclear Defense of Cities; To Provide for the Common Defense, the Case for Space Defense;* and *We Must Put an End to MADness* all advocate a defensive system of satellites and nonnuclear weapons. Graham stated, “We can place into space the means to defend these peaceful endeavors from interference or attack by hostile powers. We can deploy in space a purely defensive system of weapons satellites using non-nuclear weapons which will deny any hostile power a rational option for attacking our space vehicles or from delivering an effective first strike with ballistic missiles.”²⁶

Graham further declared, “We need not abrogate current treaties to pursue these defensive options. A United Nations treaty prohibits placement of weapons of mass destruction in space, but does not prohibit defensive space weapons.”²⁷ Graham’s challenge is defining how to assure a defensive weapon will only be used for defensive purposes.

Space Weapons and the Strategic Defense Initiative (SDI) is Crockett L. Grabbe’s bid for a strategic defense plan that does not position offensive weapons in space. Grabbe presented an overview of SDI and explored the developments between 1983 and 1991. He supports a space-based ballistic defense capability, but not the use of ASAT. Grabbe pointed out that,

The problem posed by the development of ASATs is that they put satellites in danger that play a vital role in current nuclear stability. Both sides depend upon their satellites for early warning of a nuclear attack, treaty verification, crisis monitoring, reconnaissance (spying), communication and navigation. All of these

provide vital information on the other side's activities and have been an essential link in the arms control process. Without such knowledge, it is always natural to assume the worst about what the other side is doing. In the event of a crisis, there would be a strong temptation for one side to deny information to the other side by knocking out its satellites. Such an eventuality would greatly magnify the chances of a crisis leading to a nuclear war. It is thus important that the development of these weapons be stopped by bilateral agreements to reduce the risk of nuclear war.²⁸

“Space Superiority is Fleeting” is an article published by then US Commander-in-Chief, US Space Command (USCINCSpace), General Richard B. Myers in the 1 January 2000 issue of *Aviation Week and Space Technology*. General Myers believes that the US leads today in the quest for space superiority, but also that the lead is by default and the gap is closing. Myers stated that unless the US acts now to defend its space systems, its advantage will dissolve and eventually turn against the US. Myers' plans for defense of US space assets are the following capabilities: hardening against attack, detection and reporting of an attack, ability to locate attacking systems, assessment of damage, and ability to restore capability.

Dr. David Finkleman spoke to the American Philosophical Society Millennial Symposium in April 2000 on the topic “Ballistic Missile Defense (BMD); Space and the Danger of Nuclear War.” Dr. Finkleman believes the most likely nuclear war would be a limited exchange among smaller nations with the object of intimidation, not annihilation. He stated a case that BMD is technically feasible and should be pursued as a defensive measure. “If there are no defenses, attacks with predictable, if not devastating outcomes, are more likely.”²⁹

Thus, Graham, Grabbe, Myers, and Finkleman all believe the US should employ weapons in space only as a defensive measure. Under the defensive weapons and

measures only course of action, the US should not be the first to attack another country's assets located in space.

US Possible Response: Offensive and Defensive Weapons

According to AFDD 2-2, *Space Operations*, "Offensive counterspace operations destroy or neutralize an adversary's space systems or the information they provide at a time and place of our choosing through attacks on the space, terrestrial, or link elements of a space system."³⁰ The US government supports a full-offensive and defensive space-based weapons capability. The White House published the *National Space Policy* in September 1996. It stated that, "The US considers the space systems of any nation to be national property with the right of passage through and operations in space without interference. Purposeful interference with space systems shall be viewed as an infringement on sovereign rights."³¹

Under national security space guidelines, the *National Space Policy* allows the US to assure that hostile forces cannot prevent the US use of space. The US may also counter enemy space systems and services used for hostile purposes. The *National Space Policy* supports offensive and defensive space-based weapons use for US security. The US Army, Navy, and Air Force all published individual space policies that support the *National Space Policy* position.

Former Secretary of Defense William S. Cohen discussed space control in the *2001 Annual Report to the President and Congress*. Cohen said, "Ensuring the freedom of space and protecting US national security interests in space are priorities for the Department [of Defense]."³² He defined space control's mission area as: "the surveillance of space; the protection of US and friendly space systems; the prevention of

an adversary's ability to use space systems and services; the negation or adversary space systems and services; and supporting battle management, command, control, communications and intelligence.”³³

The *National Security Strategy* (NSS) (December 1999) classified space systems as vital national interests and stated the importance of protecting them. The *National Military Strategy* (1997), which is derived from the NSS, called space systems a strategic enabler. General John Shalikashvili, former Chairman of the Joint Chiefs of Staff, singled out space control as critical to worldwide application of military power.

All military doctrine supports the development of offensive and defensive weapons in space as a method of space control. AFDD 2-2, *Space Operations* (1998), and AFDD 4, *Space Operations Doctrine* (1996), echo the *National Space Policy* and provide Airmen doctrine which outlines the fundamental principles for space operations.

The field manual (FM) 100-18, *Space Support to Army Operations* (1995), and the Training and Doctrine Command (TRADOC) Pamphlet 525-60, *Concept of Support to Land Force Operations* (1994), call space a logical extension of the battlefield. They both emphasized the need to protect space systems and declared assured access the Army's most important space requirement.

A new joint space publication is nearing completion. Joint Publication (JP) 3-14 *Tactics, Techniques, and Procedures (TTP) for Space Operations*, is still in draft form, but will focus on governing joint space activities and performance of the military in joint, multinational, and interagency operations. This publication is expected in final form this year.

Mark Helprin wrote “The War of the Lights: the Need for Strategic Defense System” for the February 1999 *National Review*. Helprin refuted the space sanctuary argument and said that the US fails to defend its citizens’ lives, land, and civilization by not aggressively pursuing offensive and defensive space-based weapons. Helprin believes that many arguments for space sanctuary revolve around the Cold War Soviet-US relationship and not around the real threat of rogue nations. He asks, “Is the US supposed to suffer an attack by a sea-launched terrorist missile or a North Korean ICBM because of arguments about the Soviet-American strategic standoff in the Eighties that were invalid then and are hardly applicable now? Even were they valid then and applicable now, are we supposed to hallucinate away the rapidly developing strategic danger from other quarters?”³⁴

“Managing ASATs: The Threat to US Space” was published by Mark Mateski in the May 1999 issue of *Jane’s Intelligence Review*. Mateski sees ASAT as a necessity because of the threat from other countries such as Iraq and North Korea. Mateski begins his article with the example of the May 1998 failure of the geostationary Galaxy VI satellite. When it failed, many pager services failed also affecting banks, hospitals, and brokerage houses. Mateski stated, “The damage caused by the loss of a key satellite can spill across an entire industry or infrastructure. For this reason alone, the incentive for a ‘second-or third-tier’ power to build and deploy an ASAT weapon for use against LEO [Low Earth Orbiting] satellites is stronger than ever before.”³⁵

Two former commanders of the US Space Command (USSPACECOM), General Howell M. Estes III and General Richard B. Myers, both gave speeches about space control. General Estes said that to keep US troops safe, the military may need to deny an

adversary's access to space or use of his space systems. Estes presented a long-range summary of programs: BMD, space based infrared system, the joint tactical ground station, GPS, and navigation warfare.

General Myers reported the current status of space control in the areas of surveillance, penetration, protection, and negation. Myers believes that the threat to US space is real and space sanctuary is too optimistic and short term. "I do not believe space is immune from the lessons of history, and one key lesson is that the only neutrality that counts comes from strength We must establish some framework for space exploitation early I'm also certain that it's just a matter of time before some nations have the means to deny space services directly. That will give them the capability; the incentive of military and economic advantage already provides the temptation--the intent. By my reckoning, those two things equal a threat."³⁶

In January 1999, Lieutenant Colonel Thomas Bell, USAF, published *Occasional Paper 6, Weaponization of Space, Understanding Strategic and Technological Inevitabilities*, for the Air War College, Maxwell, Air Force Base, Alabama. LTC Bell believes the weaponization of space is inevitable and that man will weaponize space in the next thirty years. "Just as the role of US military operations in space has gradually shifted from scientific interest, through intelligence collection, to robust combat support, so it will continue to shift inevitably toward the weaponization of space."³⁷ Bell believes that the US should pursue weaponization of space regardless of the proximity of a threat. "If no war comes, US space-based capabilities will have proven an effective deterrent force; if war does come, as the inevitable result of competition on earth or in space,

technological asymmetry will once again be a large factor in giving the US the capability for winning a decisive victory.”³⁸

The US national policies and US military doctrine all support the development of offensive and defensive space weapons. There are many advocates of the offensive and defensive weapon course of action such as former President of the US William J. Clinton, former Secretary of Defense Cohen, retired USSPACECOM commanding generals Estes and Myers, and authors such as Helprin, Mateski, and Bell. These advocates believe that US space assets are a national center of gravity and should be protected by all means possible.

Course of Action's Effect on the National Instruments of Power Diplomatic, Information, Military, and Economic

One of Paul B. Stares' books, *The Militarization of Space: US Policy 1945-1984*, is a historical source of policy from the Eisenhower administration up to Reagan's first term as president. The book examined US national space policy based on seven presidential administrations in the twentieth century. Stares believed that “The resolution of the dispute over satellite reconnaissance and the absence of an arms race in space were the results of a convergence of national interests, military disincentives, and technical constraints, which were buttressed at important times by *formal* agreements.”³⁹ Stares advocated that a diplomatic solution to the weaponization of space debate is already in effect and is sufficient.

David N. Spires compiled *Beyond Horizons: A Half-Century of Air Force Space Leadership* in 1988 as a single volume overview of the Air Force in space. It began with a review of pre-World War I rocketry developments and ended with the role of space during the Persian Gulf War. Spires then assessed the Air Force space prospects for the

new century and presented the Air Force current leadership's position on its vision for the nation's space program. This book is invaluable because most history books on space end in 1984. *Beyond Horizons* addresses the interim period between 1984 and the present day.

"Snapshots of Space Modernization" appeared in *Air Force Magazine* in January 2000. This article highlighted seventeen key USAF space programs and provided up-to-date information on experiments, production, sustainment, and upgrades. The information in this article is current as of 1 November 1999.

The RAND Corporation conducted a study from 1993 to 1994 to examine how space power affects the NSS and the conduct of future military operations. The result of this study, *SPACE, Emerging Options for National Power*, was updated in 1997. The RAND researchers explored the same three positions explored in this thesis: space sanctuary, defensive weapons and measures only, and deployment of offensive and defensive weapons. RAND explored how each course of action accomplishes space-related national security objectives, "including: (1) preserving freedom of, access to, and use of space; (2) maintaining the US economic, political, military, and technological position; (3) deterring/defeating threats to US interests; (4) preventing the spread of weapons of mass destruction to space; and (5) enhancing global partnerships with other spacefaring nations."⁴⁰ However, RAND only presents arguments; they encourage the reader to draw his own conclusions.

National Interests and the Military Use of Space was published in 1984 by the Space Working Group at the John F. Kennedy School of Government, Harvard University. Organized to study security and arms control, the Space Working Group

presented arguments on policy, national security, military planning, space system vulnerabilities and countermeasures, space-based weapons, ASAT, and the international laws governing outer space.

The US Institute for Disarmament Research published *Prevention of an Arms Race in Outer Space: A Guide to the Discussion in the Conference of Disarmament* for the United Nations in 1991. This publication defined military space activities and policies and explored the legal status of the Treaty of Outer Space, the Anti-Ballistic Missile Treaty, and the Nuclear Test Ban Treaty.

“Curbing the Spread of Nuclear Weapons” was a panel discussion organized by the International Atomic Energy Agency and the Provisional Technical Secretariat of the Comprehensive Test Ban Treaty Organization, which took place in Vienna during October 1999. The Monterey Institute of International Studies sponsored the panel and compiled the results. The resulting pamphlet provided insight into current treaties like the Nonproliferation Treaty of Nuclear Weapons and the Comprehensive Test Ban Treaty.

Many organizations such as the USAF, RAND, the John F. Kennedy School of Government at Harvard University, the US Institute for Disarmament Research, and the International Atomic Energy Agency studied the various effects of space weapons. Their research was invaluable in discerning the effects of space on the national instruments of power. Additionally, Paul Stares provided a historical look based on the space programs in the second half of the twentieth century.

Conclusion

The US government position is that there is a threat to its space assets. This warrants asking the primary question, Should the US develop and employ space-based

weapons? There is a plethora of literature exploring the US possible responses to the threat, space sanctuary, defensive weapons and measures only, or offensive and defensive weapons. It is interesting to note that although US government publications support the full offensive and defensive weapons position, the US government currently does not have any weapons capability deployed in outer space. The last question is how will the chosen course of action affect the national instruments of power: diplomatic, informational, military, and economic? The effects of the instruments of power are essential to a strategic estimate that could determine future US policy.

CHAPTER 3

RESEARCH DESIGN

The research design method used to analyze the courses of action is the strategic estimate found in JP 3-0, *Doctrine for Joint Operations*, and lesson 8 of the Command and General Staff Officer Course (CGSOC) class, Fundamentals of Operational Warfighting. The strategic estimate is a tool that unified and joint force commanders use to develop campaign and operations plans. Commanders develop strategic estimates based on the strategic environment, potential threats, the nature of possible future operations, and national strategic direction. This strategic estimate is from the viewpoint of the US and will answer the thesis primary question, should the US develop and employ space-based weapons? Chapter 3 will review the strategic estimate process.

General

This section provides general background not covered in the first two chapters of the thesis. Included is a discussion of the current status of space-based weapons and some background information on USSPACECOM.

Mission

Mission Analysis

“The first step in mission analysis is to obtain maximum clarity on the problem and assumptions from higher authorities.”⁴¹ Mission analysis determines the higher command’s, in this case the NCA’s, purpose in deciding whether or not the US should develop and employ space-based weapons. It will analyze the space-based weapons debate in accordance with the National Security Strategy (NSS) and the National Military Strategy (NMS) as well as the National and Department of Defense (DoD) space policies.

This section will state DoD assumptions and include long-term and short-term objectives for policy definition.

Mission Statement

The mission statement consists of a task and purpose in terms of: who, what, when, where and why. The “why” will encompass what the interests and objectives the mission will achieve.⁴²

Situation and Courses of Action

Situation Analysis

The situation analysis will examine the situation from a geostrategic context and analyze the potential adversary situation. The friendly situation will define the US national instruments of power--diplomatic, information, military, and economic. The potential adversary situation will examine the adversary’s capability to threaten the US. This section will explore possible methods of threat, state restrictions, and make deductions about US and potential adversary capabilities. Since the NCA confirms the existence of a threat, the situation analysis will answer the thesis question, what is the potential threat?

US Course of Action Analysis

The course of action analysis will explore the question, what should be the US response to the threat? This is where the courses of action of space sanctuary, defensive weapons and measures only, or offensive and defensive weapons are developed. Each US course of action will be examined using different instruments of power--diplomatic, information, military, or economic. The questions used to develop the courses of action are taken from Command and General Staff Officers Course’s (CGSOC) “A User’s

Guide to the Strategic Estimate.” The course of action analysis will also answer the secondary thesis question, how do the courses of action affect the national instruments of power?

1. What will be the long-term effects of using this instrument of power?
2. How quickly must the behavior of other nations or group of nations be affected?
3. Can the application of this instrument of power be sustained long enough to produce the desired result?

Once the above questions are answered for each of the four instruments of power, the next two questions will be answered for an optimal solution for the course of action.

1. What mix of instruments of power should be used?
2. How should the application of instruments of power be phased?

Analysis of Opposing Courses of Action (Threat) and Comparison of Own Courses of Action

Although JP 3-0 has analysis of opposing courses of action and comparison of own courses of action as separate actions, the CGSOC faculty recommended combining them together into one step.⁴³ In this section, each friendly course of action will be analyzed against an enemy reaction. The friendly counter-reaction will be predicted. Each course of action will then be evaluated in terms of cost, benefit, and risk as stated below.

Instrument of Power Used

Cost:

Benefit:

Risk:

National Interest of Highest Priority

Cost:

Benefit:

Risk:

Long-term Interests or Objectives

Cost:

Benefit:

Risk:

This section will conclude with a revalidation of each course of action: space sanctuary, defensive weapons and measures only, or offensive and defensive weapons, using the feasibility, acceptability, and suitability (FAS) test. The FAS test is mentioned in Appendix B of JP 3-0. It is further explained in the CGSOC class, Fundamentals of Operational Warfighting, as a method to evaluate strategy. LTC (Ret.) Ted Davis's article, "Evaluating National Security and National Military Strategy" states the following definitions of feasibility, acceptability, and suitability.

Feasibility: Are resources adequate to execute this option? Is there a reasonable chance of success?

Acceptability: Will the national will support this option? Is the benefit worth the cost?

Suitable: Will the option attain, promote, or protect the identified US interests and objectives? Is there a coherent link between political and military objectives?⁴⁴

Decision

The decision will be a concise statement of what the US should do and explain when, where, how, and why. Elements of the original courses of action may be combined into a "best" or recommended course of action.

Conclusion

The strategic estimate assists commanders in analyzing situations and selecting courses of action. It is published in JP 3-0 and is the standard used by all Commanders-in-Chief (CINCs) and services. The space-based weapons debate will easily fit into the format of the strategic estimate. The result will be an objective, well-researched course of action, which will assist a staff officer in recommending a course of action for the US.

CHAPTER 4

ANALYSIS

General

USSPACECOM Background

The US Department of Defense (DoD) established the US Space Command (USSPACECOM) on 23 September 1985 as one of the nine unified commands. Before then, the Army, Navy, and Air Force, all had fragmented space programs. Under USSPACECOM, the Services jointly pursue and protect military operations in space. USSPACECOM has the nation's command authority for military space operations.⁴⁵

There are two principal themes of the *USSPACECOM Vision for 2020*: dominating the space medium and integrating space power throughout military operations.⁴⁶ Within this vision, USSPACECOM cites four operational concepts: (1) control of space, (2) global engagement, (3) full force integration, and (4) global partnerships. Two of these operational concepts, control of space and global engagement, pertain to this thesis.

Control of space is “the ability to assure access to space, freedom of operations within the space medium, and an ability to deny others the use of space if required.”⁴⁷ USSPACECOM views space control as a classic warfighter role that mandates an established area of responsibility. According to USSPACECOM, the capabilities of space control are: real time space surveillance, timely and responsive space lift, enhanced protection (military and commercial systems), and robust negation systems.⁴⁸ Protection of existing systems and negation of enemy systems is key to USSPACECOM's operational concepts.

The second pertinent operational concept, global engagement, “is the application of precision force from, to, and through space.”⁴⁹ USSPACECOM states global engagement should offer a strategic deterrent and the potential for a global precision strike capability. The capabilities of global engagement are: non-intrusive global surveillance, key to national missile defense, enhanced command and control, and space-based strike weapons.⁵⁰ The *USSPACECOM Vision for 2020* supports the development of space-based weapons.

Current Status of Space-Based Weapons

JP 3-14 defines force application from space as, “attacks against terrestrial-based targets carried out by military weapon systems operating in and through space. Such systems could conduct counter-air, counter-land, counter-sea, and strategic attack operations.”⁵¹ AFDD 2-2 states, “There are no force application assets currently deployed in space.”⁵²

The NCA authorizes use of force in space through the *National Space Policy* and the *National Security Strategy*. However, currently space is a sanctuary. Some defensive measures are in place such as “hardening of many dedicated military satellites against electromagnetic pulse (EMP) generated by nuclear explosions and in reducing vulnerabilities to jamming.”⁵³ No space-based defensive weapons with an offensive capability are deployed.

The US can perform limited satellite negation by laser jamming or electromagnetic attack. “Current countermeasures against adversarial space systems are lacking in any significant depth, so that the accomplishment of only spotty space denial ought to be expected against a capable and determined adversary.”⁵⁴ Currently, US negation

capabilities are land based, not based in space. The US and Russia possess an ASAT capability, but have not used it against any adversaries. This ASAT capability places the US in the “Defensive Weapons and Measures Only” category as defined by this thesis.

Mission

Mission Analysis

As stated in chapter 2 of this thesis, the NCA believe there is a potential threat to critical US communications infrastructures relying on satellite systems. Also stated in chapter 2, is the US government’s official position on employing space-based weapons. The *National Security Strategy* and the *National Military Strategy* both recognize the threat to US space assets and call for offensive and defensive countermeasures. The national and individual military service space policies support the *National Security Strategy* and *National Military Strategy*. However, despite its policies, the US currently does not have any weapons employed in space.

In the *2001 Annual Report to the President and Congress*, former Secretary of Defense William S. Cohen stated, “The political, military, and economic value of the Nation’s activities in space, however, may provide a motive for an adversary to counter United States space assets.”⁵⁵ The US government recognizes the growing importance of space systems to the country and fears an attack on its space systems. Cohen further stated, “Purposeful interference with United States space systems will be viewed as an infringement on US sovereign rights.”⁵⁶ The current policies supporting space-based weapons exist to allow the US government latitude in response to an enemy attack. However, the lack of space-based weapons to achieve the space control the current policies allow for, contradicts the essence of the policies.

The DoD makes a number of key assumptions when defining the future strategic environment. Ten assumptions applicable to the space-based weapons debate are stated below.

1. Nation states will continue to fragment, sparking regional unrest.
2. The gap between “have” and “have-not” nations will widen which will create regional and possibly global unrest.
3. Non-state actors (e.g., terrorist organizations, multinational corporations, etc.) will become more important. Some of these organizations may have access to weapons of mass destruction.
4. It is unlikely that the US will face a global military peer competitor through 2020.
5. Temporary alliances will emerge as expedient ways to address various political situations.
6. The global economy will rely more on information and information processing.
7. Economic alliances will blur security agreements.
8. Commercial interests will drive most technology development, especially with space and information processing. Military, civil, and commercial space sectors are converging. Space capabilities will proliferate at a faster pace.
9. The precision and lethality of future weapons will lead to increase massing of effects rather than massing of forces.
10. The US military will increase its dependence on space. Achieving space superiority will be critical to any military’s success.⁵⁷

The long-term space-related objective of the US is to achieve space superiority whenever needed. “Unimpeded access to and use of space is and will remain a vital national interest.”⁵⁸ “The ability of the United States to access and utilize space is a vital national security interest because many of the activities conducted in space are critical to its national security and economic well being.”⁵⁹

Short-term space-related objectives of the US are “to update the aging infrastructure, enhance the command and control structure, and evolve the system from a cataloging and tracking capability to space situational awareness system capability.”⁶⁰ Note that space-based weapons are not specifically stated in the short-term plans of the US.

Mission Statement

In the twenty-first century, the US will support a strong, stable, and balanced national space program that serves US goals in national security, foreign policy, economic growth, environmental stewardship, and scientific and technical excellence. This includes protecting access to and use of space, which is central for preserving peace and protecting US national security, as well as civil and commercial interests. The US will pursue greater levels of partnership and cooperation in national and international space activities. The US will work with other nations to ensure the continued exploration and use of outer space for peaceful purposes.⁶¹

Situation and Courses of Action

Situation Analysis

Methods of Threat: There are three aspects of a space system that can be threatened, the space segment, the control segment, and the user segment. The space segment is the

satellite itself, or the means to launch the satellite into orbit. The control segment is the personnel, equipment, and facilities responsible for the operation and control of the satellite and, in many communications systems, control of users' transmissions through the satellites. The control segment consists of ground satellite control facilities, systems onboard the satellites, and communications networks linking the control facilities. The user segment is the personnel, equipment, and facilities that use the capabilities provided by the satellite payload. The user segment consists of the actual equipment that receives and transmits signals to the satellite.⁶²

In a 1994 thesis for the School of Advanced Airpower Studies, Maxwell Air Force Base, Alabama, Major James G. Lee researched *Counterspace Operations for Information Dominance*. Lee calculated the offensive counterspace capabilities of tiers one, two, and three space-capable nations. Lee's classification of tiers one, two, or three was based on the following criteria. "First tier space-capable nations possess dedicated military and civilian space capabilities on the cutting edge of technology; second tier nations develop and use dual-purpose space systems for both military and civilian purposes; and third tier nations lease or purchase space capabilities or products for military and civilian purposes from first and second tier nations."⁶³ Lee's classification of space-capable nations is as follows:

Tier One: US, Russia

Tier Two: France, Great Britain, China, Japan, India, Israel

Tier Three: Brazil, Italy, Australia, Thailand, South Africa, Canada, Iran, Iraq, Pakistan⁶⁴

Lee also developed counterspace options for tiers one, two, and three nations against the space segment, control segment, and user segment. Table 4-1 summarizes Lee's findings.

Table 1. Capabilities of Tier One, Two, and Three Nations

	Tier One Nations	Tier Two Nations	Tier Three Nations
User Segment	-jam uplink/downlink -spoofing	-jam uplink/downlink -spoofing	-jam uplink/downlink -spoofing
Control Segment	-non-lethal warfare -strategic attack -special operations	-non-lethal warfare -strategic attack -special operations	-non-lethal warfare -strategic attack -special operations
Space Segment	-nonlethal disruption -hard kill/soft kill	-nonlethal disruption	-nonlethal disruption

From Lee's research, it is clear that there is not much difference between the capabilities of tier two and tier three nations. There is also a possibility that any tier two nation that develops an adequate weapon to use against space systems will sell it to the highest bidder.

Potential Adversaries. Former Secretary of Defense Cohen identified several "states of concern" in his report, *Proliferation: Threat and Response*. This January 2001 report discusses the increasing proliferation of nuclear, biological, and chemical weapons by potential adversaries and the DoD's response. This study is important to the subject of space-based weapons because the technology used to launch ballistic missiles is the same technology used to put objects in space. The states of concern identified by Cohen are: North Korea, China, India, Pakistan, Iran, Iraq, Syria, Libya, Sudan, and Russia. Cohen

also considers transnational threats, which cross national or regional boundaries and are not otherwise easily categorized.⁶⁵ Of these states of concern, China, Russia, and India possess their own launch facilities.

At the present, the biggest threat to US space systems is ASAT weapons. The Soviet Union's Kosmos 139 ASAT carried out its first fractional bombardment in January 1967.⁶⁶ Any nation that can track satellites and fire significant payloads into space can threaten US space assets. Countries that can afford the research and development costs will be able to deploy a space-based ASAT weapon. "Russia had previously tested a co-orbital interceptor and had developed a concept for space-to-space missile platforms. Other countries have boosters that could be used for direct-ascent weapons, but not necessarily the ASAT technology."⁶⁷

North Korea surprised the world in August 1998, with the launch of a three-stage Taepo Dong 1 missile. North Korea characterized it as a space launch vehicle attempting to launch a LEO satellite. The existence of the third stage was an "unanticipated development" in the North Korean ballistic missile program. Potentially, a three-stage Taepo Dong 1 could deliver a light payload to the United States, although with very poor accuracy.⁶⁸ The indicators of a nation's ability to develop an ASAT weapon are launchers, guidance technology, and testing. "Of these indicators, launcher technology is perhaps the most critical."⁶⁹ North Korea is currently developing a longer-range missile, the Taepo Dong 2.⁷⁰

Friendly Instruments of Power. An instrument of power allows a nation the power to act and influence the global environment. "When writers and politicians talk about whether a nation has the power to act, they are usually referring to processing an

instrument of power and having the willingness to use it.”⁷¹ The US instruments of power are diplomatic, information, military, and economic. The US uses a diplomatic corps to facilitate relationships with other countries. The tools of diplomatic power are negotiations, recognition, treaties, and alliances. Information is “the conscious use of communication to inform foreign publics regarding United States policies and actions for the purpose of affecting these publics in ways favorable to US national interests.”⁷² The information instrument of power includes public diplomacy, public affairs, and psychological operations activities. The military instrument of power consists of the US military--weapons and equipment, manpower, organization, doctrine, industrial base, and sustainment capability. The US economic instrument of power is the strength and vitality of its economy and its ability to extend that economy worldwide. A strong US economy provides the ability to influence the foreign policy of other nations.

US Course of Action Analysis

The charts within this section portray the effects the instruments of power have on each course of action. The ratings, good, adequate, or poor pertain to the long term effects of applying the instrument of power, how quickly the behavior of other nations will be affected, and if the US can sustain the instrument of power long enough to produce the desired results. These ratings are in relation to each other. The desired result in all three courses of action is the protection of US space assets. After each chart is a discussion on the mix and phasing of the instruments of power.

Course of Action 1: Keep Space Sanctuary

As stated in chapter 2, space sanctuary is the act of keeping space free of space-based weapons. It also encompasses not developing terrestrial weapons that can attack

space-based assets. “The decision to weaponize space does not lie within the military (seeking short-term military advantage in support of national security) but at the higher level of national policy (seeking long-term national security, economic well-being, and world-wide legitimacy of US constitutional values.)”⁷³

The diplomatic instrument of power has definite long-term effects during space sanctuary. For example, the Limited Test Ban Treaty of 1963 prohibits nuclear tests or explosions in space.⁷⁴ The Outer Space Treaty of 1967 forbids weapons of mass destruction (WMD) to be stationed in space.⁷⁵ So far, space has been a sanctuary and many nations express the desire to keep it that way. Many nations do not focus on space as a military target. The diplomacy regarding space as a sanctuary has already spanned over fifty years. How long space sanctuary lasts is up to the world’s nations. Although the US’s and Russia’s research and development of ASAT violates the exact definition of space sanctuary, there have been no deployed ASAT weapons against another country’s space assets. Each country respects the other’s right to space.

The information instrument of power also has excellent long-term effects in the space sanctuary course of action. The US information campaign is ongoing with continued emphasis on the US National Space Policy. The policy states that first and foremost, “The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity.”⁷⁶ Former President Clinton expresses a desire to “continue to pursue global partnerships addressing space-related scientific, economic, environmental, and security issues.”⁷⁷ Other nations are affected immediately. The US is perceived as keeping the sanctuary and obeying the treaties. The US is also seen as extending the invitation to other nations to collaborate on

space activities. The information instrument of power can be sustained indefinitely by the US.

Table 2. Space Sanctuary

	Diplomatic	Information	Military	Economic
Long Term Effects?	good	good	adequate	good
How quickly other nations affected?	good	good	good	good
Can US sustain?	good	good	good	good

The long-term effects of space sanctuary on the US military are only “adequate.” “Space systems have become integral to military operations from the strategic level all the way down to the tactical level of warfare.”⁷⁸ Although other nations have supported space sanctuary in the past, if an adversary were to deny the military use of space assets, it would seriously impact the ability of military units to command and control their forces. It is in the best interests of the military to protect US space assets. However, because of the military’s redundant communications systems, this did not receive a “poor” rating. By pursuing a space sanctuary course of action, the military would not lose money and personnel to the space program. The military could easily sustain itself within this course of action.

The long-term effects of the economic instrument of power would be “good” under space sanctuary. It is cheaper for the US to pursue no further action. Other nations are not under pressure to keep up with the US space program. In fact, the US policy is to

develop global partnerships to share in space research and development. This benefits all participating nations and can be sustained indefinitely.

In the space sanctuary course of action, the national instruments of power should be phased as follows: diplomatic, economic, and military. The information instrument is applied within and supporting the other three. Diplomacy in the form of treaties signed by many nations is the most effective instrument of power at the start of space sanctuary. If a nation is contemplating violating a treaty, economic pressure can be applied to keep it in line. And if sanctuary fails, employ the military. The military should be the last resort in this course of action.

Course of Action 2: Defensive Weapons and Measures Only

According to the US Air Force, the definition of counterspace operations is:

Active and passive actions to protect US space related capabilities from enemy attack or interference Active defense operations include conducting surveillance of adversary launch sites, identifying and neutralizing blinders and jammers, and maneuvering spacecraft. Reporting potential and known space system attacks is an important aspect of active defense Passive defense includes survivability measures such as redundancy, filtering, frequency hopping, command and mission data link encryption, and hardening. Also, camouflage, concealment, deception, redundancy, mobility, and dispersion can defend elements of a space system.⁷⁹

“Defensive” counterspace operations “consist of active and passive actions to protect US space-related capabilities from enemy attack or interference.”⁸⁰ Any lethal protection methods are strictly reserved for use in defense of an attack only.

Diplomacy is rated “adequate” for the long-term effects of the defensive weapons and measures only course of action. The caveat in the Air Force definition of counterspace, that it may also include the employment of lethal protection methods, makes diplomacy a challenge for the US. Perhaps the most often quoted phrase of the

National Space Policy is, “The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity.”⁸¹

Employing lethal protection methods does not appear to support the US peaceful position. Other nations would not be so quick to accept the US stationing defensive weapons in space. Although the US could sustain a defensive weapons posture, it would probably not produce the desired effect. The nations competitive with the US would strive to duplicate whatever defensive weapons the US possessed. A possible result is an escalated space arms race.

Table 3. Defensive Weapons and Measures Only

	Diplomatic	Information	Military	Economic
Long Term Effects?	adequate	good	adequate	poor
How quickly other nations affected?	adequate	adequate	good	adequate
Can US sustain?	adequate	good	adequate	adequate

The information instrument of power could have “good” long-term effects. It can be argued that the defense of a nation’s space systems is perfectly legitimate. In fact, the *National Space Policy* also states, “Purposeful interference with space systems shall be viewed as an infringement on sovereign rights.”⁸² It would be easy for the US to say, these assets are ours. If you pose a threat to our assets, we will attack you in defense of our assets. This may not be immediately accepted by all other nations. Some may feel

threatened by yet another US offensive capability. But over time, the US could sustain the information instrument of power.

The defensive weapons and measures course of action would have an “adequate” effect on the military. While the military would now have an ability to protect its space assets, the military would have to restructure to support it. Lieutenant Colonel Cynthia McKinley, USAF, proposed a separate “US Space Guard,” similar to the US Coast Guard.⁸³ McKinley’s organization would draw personnel from the military National Aeronautics and Space Administration (NASA), Department of Transportation, and the Federal Aviation Administration (FAA). According to McKinley, the space guard could draw funding from DoD, military, civil, and commercial sources.

Additionally, The 2001 *Report of the Commission to Assess US National Security Space Management and Organization* also proposed a separate space corps.⁸⁴ The space guard is a good idea and a noble concept. But when looking at it strictly from a military view, the personnel and money drawn away from the rest of the US military would affect the military’s ability to perform its other missions. The creation of a US space force would affect other nations quickly. Some would attempt to duplicate and some would attempt to defend against a new US initiative. The military’s ability to develop and sustain a separate space force and a defensive weapons posture would depend on the current presidential administration’s priority for the space program.

If the right emphasis were placed on it, the military’s capabilities would benefit from this course of action. Defensive weapons advocate, Lieutenant General (Ret.) Daniel O. Graham, USAF said,

Perhaps, the most damaging of all oversights in the past twenty years has been the failure to appreciate the real payoff to defensive systems in the nuclear age--that

of destroying the aggressor's confidence in any of his own nuclear attack plans. If an aggressor must first penetrate a defensive system, he cannot possibly anticipate how many, which ones, or whether his weapons will explode where intended . . . thus defense is essential to effective long-lasting deterrence.⁸⁵

While in the end the result could be favorable, the military instrument was rated “adequate” because of the time it would take to employ and its dependence on the current presidential administration.

Economically, it is expensive for the US to pursue and sustain the defensive weapons and measures course of action. The long-term effects on the economic instrument of power were rated “poor” because the US would have to sacrifice something else for this expensive endeavor. Other nations would have to decide if they could afford to join the US in developing defensive weapons. As stated earlier, the US capacity to sustain this course of action depends on the current presidential administration's priorities for the space operations.

If the defensive weapons and measures only course of action is chosen, the instruments of power should be phased: military, diplomatic, and economic. The information instrument is applied supporting the other three and will have to be quite extensive to be effective. Money and resources should be diverted to the military to build a defensive space program. Should the US select this course of action, it is important that first priority be given to the military to create an effective defense system. Diplomacy will also be important to build support among the allies and to reassure potential adversaries that it is merely a defensive measure. The economic instrument should be applied within the US to support the program. The money should be focused within the US instead of on pursuits in other countries.

Course of Action 3: Offensive and Defensive Weapons

Air Force doctrine maintains that offensive counterspace operations:

Destroy or neutralize an adversary's space systems or the information they provide at a time and place of our choosing. Offensive counterspace operations use lethal or nonlethal means to achieve five major purposes: deception, disruption, denial, degradation, and destruction of space assets or capabilities.”⁸⁶

The full offensive and defensive weapons course of action is supported by the US *National Security Strategy*, *National Military Strategy*, *National Space Policy*, and all military doctrine.

The long-term effects of diplomacy in the offensive and defensive weapon course of action are rated “poor” because of the competitive nature of nations. If the US deploys offensive and defensive space-based weapons, other nations will reply in kind.

Historically, the competitive nature of nations was evidenced by Mutually Assured Destruction (MAD). “MAD holds that United States security and the avoidance of nuclear war is entirely dependent on the maintenance of a balance of terror in which both the US and the Soviet Union can absorb a nuclear first strike and still be able to wreak such terrible vengeance that neither side will ever use nuclear weapons.”⁸⁷ The deployment of space-based weapons could recreate the MAD situation. It will be difficult for diplomats to portray the US in a favorable light while the US deploys weapons in space. As long as the US possesses overwhelming force, there will always be a contingent that views the US as a potential enemy.

One program under consideration is the space-based laser, which would be used primarily for ballistic missile defense. However, the Anti-Ballistic Missile Treaty of 1972 currently prohibits deployment of this kind of weapon.⁸⁸ If the US knowingly violates a signed treaty, diplomatic relations may suffer.

On the other hand, other nations will be immediately affected. Dr. David Finkleman, the US Director of Aerospace Analysis, believes, “Even allies pursue nuclear weapons to establish themselves among the great powers.”⁸⁹ As during the development of nuclear weapons, the Allies will draw closer and potential enemies more distant, and many nations will develop space weapons.

Table 4. Offensive and Defensive Weapons

	Diplomatic	Information	Military	Economic
Long Term Effects?	poor	adequate	good	poor
How quickly other nations affected?	good	adequate	good	adequate
Can US sustain?	poor	good	poor	adequate

The long-term effects of the information instrument of power are “adequate.” No matter what the US says, its actions show an increase in offensive capability. Other nations are more likely to react to an action instead of a spoken word or written agreement. Upon deployment of the first space-based weapon, other nations will be affected immediately. The US can sustain its information instrument indefinitely.

The long-term effects on the military are “good.” The US military will be much more powerful with a space-based weapons capability until another nation develops a similar system. The goal is to “allow friendly forces to exploit space capabilities, while negating the enemy’s ability to do the same.”⁹⁰ As stated in the diplomacy paragraph, when the first weapon is deployed, other nations will be affected immediately. The US

military may not be able to sustain this new capability. Since the US is between major conflicts right now, the military is shrinking and defense dollars are diverted elsewhere. The US population does not perceive a large threat and therefore will not support a large military, as evidenced by the massive military drawdown after the Persian Gulf War.

The long-term effects economically are “poor.” Developing and launching something into space is incredibly expensive. The DoD space budget peaked during 1988-1989.⁹¹ As seen in the 1990s, when the presidential administration did not put priority on the space program, it did not receive funds. In the past, space-based weapons programs have been started and never completed. Other nations will put money into their space weapons programs only if the US is doing the same. Like the defensive weapons only course of action, the economic priority varies with the presidential administration, so it may or may not be sustained.

The phasing of the instruments of power during this course of action should be: diplomatic, economic, military. The information instrument is applied supporting the other three and will also have to be quite extensive to be effective. Developing offensive and defensive space-based weapons will be controversial and expensive. Diplomacy must still be the number one priority if the US is to avoid conflict with other nations. Russian Defense Minister Marshall Igor Sergeev predicts conflicts with other nations if the US violates the 1972 Anti-Ballistic Missile Treaty.⁹² The US should attempt to maintain friends and try not to develop new enemies. Economic must be the next because of the large costs involved in space operations. If the military is chosen, it must become a priority and receive all the benefits of the other instruments of power.

4 and 5 Analysis of Opposing Courses of Action (Threat) and

Comparison of Own Courses of Action

Although JP 3-0 has analysis of opposing courses of action and comparison of own courses of action as separate actions, the CGSOC faculty recommended combining them together into one step.⁹³ In this section, each friendly course of action will be analyzed against an enemy reaction. The friendly counter-reaction will also be predicted. Each course of action will then be evaluated in terms of cost, benefit, and risk for: instrument of power used, national interest of highest priority, and long term objective.

This section will conclude with a revalidation of each course of action: space sanctuary, defensive weapons and measures only, or offensive and defensive weapons, using the FAS test. The FAS test is mentioned in Appendix B of JP 3-0. It is further explained in the CGSOC course, Fundamentals of Operational Warfighting. Lieutenant Colonel Ted Davis's article, "Evaluating National Security and National Military Strategy" states the following definitions of feasibility, acceptability, and suitability.

Feasibility: Are resources adequate to execute this option? Is there a reasonable chance of success?

Acceptability: Will the national will support this option? Is the benefit worth the cost?

Suitable: Will the option attain, promote, or protect the identified US interests and objectives? Is there a coherent link between political and military objectives?⁹⁴

Course of Action 1: Keep Space Sanctuary

Should the US decide to keep space sanctuary, potential adversaries have two choices, to develop or not to develop space-based weapons. This also includes not building terrestrial weapons aimed at destroying targets deployed in space. If the US does not pursue space-based weapons, many potential adversaries will not feel the need

to either. As stated previously, Russia already has an ASAT weapon. However, Russia's space program is not faring too well currently, according to John Pike:

The Russian space program is but a pale shadow of that of the Soviet Union, with annual flight rates having declined from 125 each year in the late 1980's to no more than roughly two dozen annual launches recently. Modest success in the international commercial launch services market cannot compensate for the virtual collapse of scientific missions, and the visible weakness of the Russian piloted spaceflight effort is mirrored in substantial though less widely appreciated retrenchment in national security programs. While Europe, Japan, India, and China have achieved varying degrees of success in commercial and scientific space activities, their piloted spaceflight and national security space activities are dwarfed by those of even Russia, and are entirely incomparable to those of the United States. Israel, Brazil, and a few other countries remain barely on the threshold of space.⁹⁵

This USAF reports Russian military and civilian space launches in 1987 as sixty-two military and thirty-three civilian. This number steadily declined throughout the 1990s. In 1999, there were six military and twenty-two civilian Russian space launches.⁹⁶ As for other countries, in 1987 China had two launches, Japan had three, and Europe had two. In 1999, China had four launches, Europe had ten, and India had one.⁹⁷

If the US pursues space sanctuary and other nations develop space-based weapons, the US will be at a severe disadvantage. The US military is dependent on space for communications and navigation. Brigadier General Michael A. Hamel, the Director of Requirements at US Air Force Space Command, stated that the bandwidth capacity supporting Allied Force in Kosovo in 1998 was five times that used during the Gulf War in 1991.⁹⁸ Civilian industries depend on space assets also. "The failure of the Galaxy IV (May 98) and the loss of TV and pagers gave us a taste of how dependent the civil sector has become on space capabilities."⁹⁹

As a counter-action against a strike on US space systems, the US would probably start building defensive weapons. The US could not let anyone take away the command

and control and navigation capability they receive from satellites. The US would have to act, and it would probably be with the military instrument of power.

Primary Instrument of Power Used

The primary instrument of power used by course of action 1 is diplomatic.

Cost: Nothing significant. People are already in place in embassies and shared space research facilities are all over the world.

Benefit: If the US keeps the status quo, everyone benefits. No country will have a need for defensive weapons if the US does not develop a weapon that can strike other countries' space assets.

Risk: Potential adversaries can interfere with the US communications systems. If a potential adversary has a weapon and the US cannot match it, the US will appear weak to the world.

National Interest of Highest Priority

“Unimpeded access to and use of space is and will remain a vital national interest.”¹⁰⁰

Cost: Inexpensive. Deploying no further weapons, as an offense or defense will cost nothing.

Benefit: As long as all nations respect the sanctuary, space can be a joint endeavor with other nations. The US can also track other nations' development status if working closely with them.

Risk: Someone may develop a weapon to deny the US access to space.

Long-Term Objective of US

The long-term objective of the US is to achieve space superiority whenever needed.

Cost: Inexpensive. Deploying no further weapons as an offense or defense will cost nothing.

Benefit: The US will always have access and should know what all nations have deployed in space.

Risk: Another nation can deny the US access to space assets if the US is unprepared. Under space sanctuary, the US cannot meet the long-term objective to deny other countries access to their own space assets, a condition of space superiority.

Space Sanctuary FAS Test

Feasibility: The US has adequate resources to execute space sanctuary. Space sanctuary has basically been around for 50 years, it can definitely last longer.

Acceptability: The nation would support this option. Economically, the cost is low. The benefit is worth the cost.

Suitability: Space sanctuary is suitable as long as all nations respect the sanctuary. There is a coherent link between political and military objectives. Both want free and assured access to space. However, space sanctuary cannot deny an enemy use of his own space assets, a condition of space superiority.

Course of Action 2: Defensive Weapons and Measures Only

The US is already in the Defensive Weapons and Measures Only category because it possesses an ASAT capability. The definition of defensive counterspace includes active measures such as lethal protection methods.¹⁰¹ The US Army Space and Missile Defense Command believes that, “Direct attack against a satellite has historically

been a capability only the US and former Soviet Union possessed. China may also have the capability to deploy ASAT weapons. However, global technology will lead to the proliferation of ASAT threats especially threats against LEO systems.”¹⁰² Former Secretary of Defense Cohen, also believes other countries will develop ASAT weapons. “The political, military, and economic value of the Nation’s activities in space, however, may provide a motive for an adversary to counter United States’ space assets.”¹⁰³ If the US continues to build defensive weapons that can attack other countries’ space assets, it is not unrealistic to believe other countries will develop their own ASAT also.

The US counter-reaction to an enemy build-up of offensive weapons for defensive purposes could possibly be a treaty to either reduce the number of weapons in the inventory or limit the number of weapons made. The US would probably try a diplomatic solution first.

Primary Instrument of Power Used

The primary instrument of power used in course of action 2 is military.

National Interest of Highest Priority

“Unimpeded access to and use of space is and will remain a vital national interest.”¹⁰⁴

Cost: The cost of defensive weapons and measures is significantly higher for research and development than space sanctuary. There is a low end, where an ASAT is deployed from a terrestrial weapon and a more expensive option of basing an ASAT weapon actually in space.

Benefit: Other countries may not employ their ASAT weapons for fear of retaliation in kind.

Risk: Developing ASAT weapons may cause other nations, who would not otherwise pursue this course of action, to develop space weapons.

Long-Term Objective

The long-term objective of course of action 2 is to achieve space superiority whenever needed.

Cost: The cost can either be low or high depending on the defense weapon chosen. The cost is more expensive than space sanctuary and less expensive than a full offensive and defensive weapons capability.

Benefit: The US would be able to deny other nations access to their space assets, which is a condition of achieving space superiority.

Risk: Nations who do develop ASAT as a result of the US choice to develop defensive ASAT weapons may actually target and affect US satellites.

Defensive Weapons and Measures Only FAS Test

Feasibility: The US already possesses the resources and capability to execute defensive weapons and measures only. Since the 1960's ASAT weapons have existed and neither the US nor Russia has targeted each other's space assets. History proves there is a reasonable chance of success that this stand off can be maintained.

Acceptability: The nation will support this option also. Since the US is already in this category, it would be maintaining the status quo.

Suitability: The defensive weapons and measures only course of action should protect the US interests. Since it includes an offensive capability, the US can strike back if attacked. There is a coherent link between political and military objectives. Both want assured access to space and the capability to deny it to a potential adversary.

Course of Action 3: Offensive and Defensive Weapons

The full offensive and defensive weapons course of action is supported by the US *National Security Strategy*, *National Military Strategy*, *National Space Policy*, and all military doctrine. “Control of space is not only important to ensure access to satellites but to support military operations on the earth Any disruptions to military access to space could jeopardize American military activities as reliance on space assets is increasingly becoming a strategic center of gravity for the US.”¹⁰⁵

A potential adversary would probably try to match any weapons system the US developed. “Russia is ready to match any new missile defense technology developed by the United States if the latter violates the terms of the 1972 Anti-Ballistic Missile Treaty, according to Russian Defense Minister Marshall Igor Sergeev.” Sergeev also predicted that “some other countries” would do the same.¹⁰⁶ There is no reason to think a potential adversary would not try to compete with the US or at least develop a more dangerous capability.

The US counter-reaction would be to develop a weapon to counter the potential adversary’s weapon. It could spark a space weapons race cycle.

Primary Instrument of Power Used

The primary instrument of power used in course of action 3 is military.

National Interest of Highest Priority

“Unimpeded access to and use of space is and will remain a vital national interest.”¹⁰⁷

Cost: It will be extremely expensive to develop a full offensive and defensive capability.

The US government would have to place much more emphasis and money on the program for it to be successful. The cost will be significantly higher than either of the other two courses of action.

Benefit: With a full offensive and defensive capability, the US could deter an attack on its space systems and perhaps prevent an attack already in progress.

Risk: “There is a real difference between having the means to carry out offensive operations against an adversary’s assets in space or near-space and the political will to do so.”¹⁰⁸ Once the US develops this capability, the political leadership may not allow it to be used. There is also a possibility that the system may not defeat every enemy attack.

Long-Term Objective

The long-term objective of course of action 3 is to achieve space superiority whenever needed.

Cost: The cost will be significantly higher than either other the other two courses of action.

Benefit: The US could possibly achieve space superiority and the capability to use or deny space assets at a time and place of their own choosing.

Risk: Other countries could develop similar systems and the world could enter a phase of proliferation/counterproliferation of space weapons.

Offensive and Defensive Weapons FAS Test

Feasibility: The US could resource this course of action, but it would cost a lot of money. Right now, the doctrine and policies of the US claim to support developing offensive and defensive weapons, but there are no weapons actually deployed. For this

course of action to work, the US government would have to make a long-term commitment to fund this effort and it is not possible to predict that, given that the term of a US president is only four years. A new US president could easily dismantle a program that took years to build simply by not funding it.

Acceptability: The U.S public would accept this option only on the condition that the threat was large enough. If the US used it for other than a military purpose, the country would not accept it.

Suitability: The offensive and defensive weapons option could possibly protect the US assured access to space, as long as the system worked. However, there is not a coherent link between the political and military objectives, because the politicians do not always allow the military to use the weapons at their disposal, at a time and place of the military's choosing.

Decision--Conclusion

At this time, the US should choose the defensive weapons and measures only course of action. While space sanctuary appears to be the best choice when considering the national instruments of power, it does not pass the FAS test because of the defined goals of US national policy. The goal is to achieve space superiority by protecting US space assets while denying the enemy's use of his own space assets. Space sanctuary cannot deny the enemy use of his own systems.

The offensive and defensive weapons course of action is the worst option when considering the national instruments of power. It would only pass the FAS test on the condition that the political leadership and the military will continue to have mutually

supporting positions on the issue. This is not possible to determine because the US political leadership potentially changes every four years.

However, the offensive capability of the terrestrial based ASAT weapon and US passive defense measures are enough accomplish the US goals. There is no reason to violate the sanctuary of space with a full-blown offensive and defensive weapons program, until an adversary provides a more lethal threat. The US does not want to lead the way toward a proliferation of space-based weapons battle. The US can and should conduct preliminary research toward a more powerful offensive capability. But, the US should resist the urge to rush headlong into a mission that may not have political support at execution. Presently, the defensive weapons and measures only is the best course of action.

CHAPTER 5

CONCLUSION

Summary

The purpose of this thesis was to answer the question, should the US develop and employ space-based weapons? The answer to that is yes, the US should develop space-based weapons, but only as a defensive measure. There are several questions that were answered before reaching that conclusion.

The first question was, what is the threat? Currently there are no weapons based in space. Likewise, no nation has physically attacked another's space assets with terrestrial weapons. However, the NCA of the US believe there is a real threat to US space systems. The US's dependence on space systems is steadily increasing. As a result, the US national security and military strategies allow for the development of space-based weapons to protect US space assets.

The next question was, what should be the US response to the threat? The courses of action examined were (1) keep space sanctuary and do nothing, (2) develop defensive weapons only, and (3) develop offensive and defensive weapons. The three courses of action were developed using the strategic estimate format found in JP 3-0, *Doctrine for Joint Operations*. All courses of action were then examined using the FAS test, also from JP 3-0. The outcome of the strategic estimate and the FAS test is for the US to pursue the defensive weapons and measures only course of action. Since the US is already in this category, it means maintenance of the status quo.

The last question was, how do the courses of action affect the national instruments of power--diplomatic, information, military, and economic? Each course of action was

evaluated against its effects on the national instruments of power. Course of action 1, keep space sanctuary, is the best choice for the US using this method of evaluation.

Space sanctuary is easy diplomatically, adequate militarily, and economically inexpensive because it requires no action. The US could easily defend it in the media.

Course of action 2, develop defensive weapons and measures only was second choice. The need for defensive weapons is understandable diplomatically, adequate militarily, and can be, but does not have to be expensive, depending on the type of defense being considered. A defensive weapons posture is easier to support to the media than a full offensive and defensive weapons strategy.

Developing offensive and defensive weapons was the least favorable option when considering the national instruments of power. It would be difficult diplomatically to gain other countries' support for US offensive weapons in space as evidenced by the Russian and Chinese efforts to develop treaties to the contrary. Militarily, offensive and defensive weapons would be a benefit. Economically, offensive and defensive weapons are costly. The NCA would have to prioritize the space weapons program to gain budget support for it.

Once the courses of action were developed, the FAS test was then applied to determine if the chosen course was viable in terms of resources, national will, and accomplishing its objectives. The space sanctuary course of action was not suitable because of the current US policies not prohibiting space-based weapons, and the US desire for space superiority, that requires the ability to deny an adversary the use of space. The offensive and defensive weapon course of action would be feasible, acceptable, and suitable only if the threat was higher and the US president prioritized the

program. This course of action would be very expensive and would require total support from the US government and population to be acceptable. Only course of action 2, develop defensive weapons and measure only, was feasible, acceptable, and suitable.

It is necessary to combine the two evaluation techniques, the strategic estimate and the FAS test, in order to reach a conclusion. The strategic estimate assists in developing the strategy or course of action and the FAS test evaluates it. As a result of the strategic estimate, the US should attempt to preserve the sanctuary of the space for as long as possible and concentrate on terrestrial solutions for denying an adversary's access to space. The defensive weapons and measures only course of action is workable concerning the national instruments of power and is also feasible, acceptable, and suitable.

Suggestions for Further Research

An excellent topic for further research would examine exactly what the US's dependence on space systems is for the civilian and military sector. This is one area that is mentioned in almost every study, but there has been no comprehensive inquiry into the topic. This study could include the types of systems involved and predictions of what would happen if the US were denied access to critical space systems.

Another potential topic is the US military increasing reliance on commercial systems. Is there duplication between military and commercial systems? Would it be better for the military to outsource space systems to the civilian community or continue retain a separate capability within the military?

The last topic for further research is how to coordinate space support in a multinational environment. A possible angle for this topic is the US-Canadian

relationship. How can the lessons learned working with Canada apply to a joint and combined task force type environment where allied forces either have or do not have access to space systems?

Conclusion

This thesis presents an objective view of the weaponization of space debate. The concepts were developed using a joint US military planning tool, the strategic estimate. It involved developing three courses of action: space sanctuary, offensive weapons and measures only, and offensive and defensive weapons. The courses of action were then evaluated using another joint US military planning tool, the FAS test. Previous studies routinely pick one of the courses of action and impart a one-sided defense argument without considering any alternate courses of action.

This thesis also presents the NCA's documentation of the threat to US space systems at the unclassified level. Previous studies assume threat, but do not document where the authors obtained threat information.

The answer to the primary question posed by this thesis, should the US develop and employ space-based weapons is yes; the US should develop and employ space-based weapons, but only as a defensive measure.

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